

# NASA Success Story

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## Aspen Systems Aerogel Technology



Aspen Systems, Inc., of Marlborough, Massachusetts is a leading manufacturer of aerogels in the U.S. Aerogels have very high thermal insulation values, Infrared (IR) shielding, and acoustic and shock absorption characteristics. Aspen has been developing various aerogel products and technologies starting with a Small Business Innovation Research (SBIR) contract in 1993 with NASA at Kennedy Space Center. The work involved the development of flexible aerogel insulation for cryogenic applications. In March 1999 Aspen invented a high-speed, low-cost manufacturing process for aerogels for which Aspen received the prestigious SBIR Technology of the Year Award in Manufacturing/Materials in November 1999. The new process provides dramatic cost reductions in the manufacture of aerogels. Aspen plans to mass-produce aerogels using this new method and open world markets for building insulation, skylights/windows, clothing, home appliances, aerospace, automotive, cryogenics, and other applications. The potential worldwide market for low-cost aerogels is projected to be \$10 billion a year by 2005. A 1000-liter pilot plant based on this new aerogel production process is being built to start production by late 2001. Aspen currently offers three aerogel product lines: Cryogel (r), Pyrogel (r), and Polar Bear (tm), for low, high, and medium temperature applications, respectively. Aspen is also producing an inexpensive, resilient, low dusting, and extremely flexible blanket

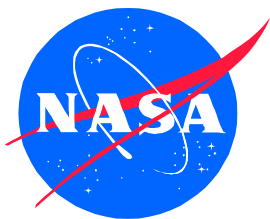
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**Page 1**



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called Spaceloft (tm), and a thin aerogel imbedded fabric called Aerotex (tm), developed in a research and development program. These are advanced versions of the flexible aerogel insulation originally developed under the KSC Phase II SBIR contract. They are now being used at NASA's Johnson Space Center to develop advanced spacesuit insulation and mittens. In January 2001, the Italian apparel manufacturer Corpo Nove manufactured the Extreme Weather Jacket using Spaceloft (tm). This specialty jacket was designed for harsh weather conditions such as Antarctic expeditions and will be sold by Hugo Boss.

**NASA Involvement** Aspen Systems responded to NASA's need for an aerogel-based cryogenic insulation system with extremely low thermal conductivity that is flexible, durable, and easy to use. Prototype aerogel composite systems are currently being field tested at KSC. The basic form of the system is a blanket composed of aerogel-based composites and radiation shield layers. The final product can be a blanket, sheet, or clamshell unit, depending on the application. Potential space applications include the Reusable Launch Vehicle, Space Shuttle upgrades, and interplanetary propulsion and life support equipment. The aerogel composites have been utilized in the construction of two research cryostats, which are currently used for thermal measurements at the KSC Cryogenics Test Laboratory. Thriving spaceports of the future will rely on new approaches to the distribution and control of cryogenic propellants, which are typical for space launch applications. The new aerogel products will likely be a key element in development of economical high-efficiency pipelines for the long distance transfer of cryogenics. Prototype aerogel insulation systems have already been put to use on the feedlines of the liquid oxygen and liquid hydrogen launch umbilical systems for the X-33 experimental spacecraft.

**Social/Economic Benefit** In addition to its high speed, another crucial characteristic of Aspen's new process is that its speed can be virtually independent of production equipment size. This is in stark contrast to the conventional supercritical aerogel drying method. The new process can be used for producing large aerogel panels or blankets in a fast batch process. The same method will dry aerogel beads in such a short period that connecting multiple extractors to a single wet gel process stream will approach the functionality of a fast continuous process. Aerogel was first developed in 1931, and is called the lightest solid ever made. It holds six world records for a solid, and widespread use of aerogel-based insulation would significantly reduce energy consumption and emissions of greenhouse gases without forcing changes in lifestyle or industry practices on a global scale.

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**Page 2**